steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0093] As used herein, the term "if" may be construed to mean "when" or "upon" or "in response to determining" or "in accordance with a determination" or "in response to detecting," that a stated condition precedent is true, depending on the context. Similarly, the phrase "if it is determined [that a stated condition precedent is true]" or "if [a stated condition precedent is true]" or "when [a stated condition precedent is true]" may be construed to mean "upon determining" or "in response to determining" or "in accordance with a determination" or "upon detecting" or "in response to detecting" that the stated condition precedent is true, depending on the context.

What is claimed is:

1. A method comprising:

obtaining a point cloud of a scene including a plurality of points in a gravity-aligned coordinate system;

generating, based on the plurality of points, a line-space image, each pixel of the line-space image corresponding to a two-parameter representation of a respective line at a common height in the gravity-aligned coordinate system and each pixel having a pixel value; and

generating one or more vertical plane hypotheses based on the line-space image.

2. The method of claim **1**, wherein each of the plurality of points is associated with three coordinates in the gravity-aligned coordinate system, one of the three coordinates corresponding to a height of the point.

3. The method of claim **2**, wherein generating the line-space image comprises processing the plurality of points of the point cloud without the one of the three coordinates corresponding to the height of the point.

4. The method of claim **1**, wherein each pixel of the line-space image corresponds to a respective slope-intercept representation of the respective line.

5. The method of claim **1**, wherein each pixel of the line-space image corresponds to respective distance-angle representation of the respective line.

6. The method of claim **1**, wherein generating the line-space image includes performing a Hough transform on a two-dimensional point map of unpaired points of the point cloud.

7. The method of claim **1**, wherein each of the plurality of points is further associated with an uncertainty.

8. The method of claim **1**, wherein generating the line-space image includes:

selecting two points of the point cloud;

determining two parameters of a line projected to the common height in the gravity-aligned coordinate system defined by the two points; and

incrementing, by an amount, a pixel value of a pixel of the line-space image corresponding to the two parameters.

9. The method of claim **8**, wherein selecting the two points of the point cloud includes randomly selecting two unpaired points of the point cloud.

10. The method of claim **9**, wherein generating the line-space image includes repeatedly:

selecting two points of the point cloud:

determining two parameters of a line projected to the common height in the gravity-aligned coordinate system defined by the two points;

determining a probability distribution of the two parameters based on the two parameters and the respective uncertainties of the two points; and

increasing, by an amount, pixels values of a plurality of pixels of the line-space image corresponding to the probability distribution of the two parameters.

11. The method of claim **10**, wherein selecting the two points of the point cloud includes randomly selecting two unpaired points of the point cloud.

12. The method of claim **10**, wherein selecting the two points of the point cloud includes selecting two paired points of the point cloud and the pixel values are increased by the amount scaled by a length of the line.

13. The method of claim **8**, wherein selecting the two points of the point cloud includes selecting two paired points of the point cloud and the pixel value is incremented by the amount scaled by a length of the line.

14. The method of claim **1**, wherein generating the one or more vertical plane hypotheses includes determining that one or more pixel values are greater than a threshold and generating one or more vertical plane hypotheses corresponding to the one or more pixel value greater than the threshold.

15. The method of claim **11**, wherein generating the one or more vertical plane hypotheses includes detecting one or more peaks in the line-space image and generating one or more vertical plane hypotheses corresponding to the peaks.

16. The method of claim **15**, further comprising:

applying a non-maxima suppression algorithm to the line-space image.

17. The method of claim **1**, wherein generating the one or more vertical plane hypotheses includes generating one or more sets of planar coefficients, each set of planar coefficients defining a vertical plane intersecting a respective one of the one or more lines.

18. A device comprising:

one or more processors;

a non-transitory memory;

one or more scene cameras; and

one or more programs stored in the non-transitory memory, which, when executed by the one or more processors, cause the device to:

obtain a point cloud of a scene including a plurality of points in a gravity-aligned coordinate system;

generate, based on the plurality of points, a line-space image, each pixel of the line-space image corresponding to a two-parameter representation of a respective line at a common height in the gravity-aligned coordinate system and each pixel having a pixel value; and

generate one or more vertical plane hypotheses based on the line-space image.

19. The device of claim **18**, wherein generating the line-space image includes:

selecting two points of the point cloud;

determining two parameters of a line projected to the common height in the gravity-aligned coordinate system defined by the two points; and

incrementing, by an amount, a pixel value of a pixel of the line-space image corresponding to the two parameters.

20. A non-transitory memory storing one or more programs, which, when executed by one or more processors of a device with one or more scene cameras, cause the device to: